

CLAIMS

1. A substantially purified or isolated nucleic acid or nucleic acid fragment encoding an ice recrystallisation inhibition protein (IRIP) from a *Deschampsia* species, or a functionally active fragment or variant thereof.
- 5 2. A nucleic acid or nucleic acid fragment according to claim 1 wherein said *Deschampsia* species is *Deschampsia antarctica*.
3. A nucleic acid or nucleic acid fragment according to claim 1 or 2 including a nucleotide sequence selected from the group consisting of (a) sequence shown in Figures 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, 23 and 24 hereto; (b) complements of the sequences recited in (a); (c) sequences antisense to the sequences recited in (a) and (b); (d) functionally active fragments and variants of the sequences recited in (a), (b) and (c); and (e) RNA sequences corresponding to the sequences recited in (a), (b), (c) and (d).
- 10 4. A substantially purified or isolated nucleic acid or nucleic acid fragment encoding an IRIP from a *Lolium* or *Festuca* species, or a functionally active fragment or variant thereof.
- 15 5. A nucleic acid or nucleic acid fragment according to claim 4, wherein said *Lolium* or *Festuca* species is perennial ryegrass (*L. perenne*).
6. A nucleic acid or nucleic acid fragment according to claim 4 or 5 including a nucleotide sequence selected from the group consisting of (a) sequences shown in Figures 26, 27, 29 and 30 hereto; (b) complements of the sequences recited in (a); (c) sequences antisense to the sequences recited in (a) and (b); (d) functionally active fragments and variants of the sequences recited in (a), (b) and (c); and (e) RNA sequences corresponding to the sequences recited in (a), (b), (c) and (d).
- 20 25 7. A substantially purified or isolated regulatory element from an IRIP nucleic acid from a *Deschampsia* species, or a functionally active fragment or variant thereof.

8. A regulatory element according to claim 7 including a nucleotide sequence selected from the group consisting of (a) sequences shown in Figures 32 and 33 hereto; (b) complements of the sequences recited in (a); and (c) functionally active fragments and variants of the sequences recited in (a) and (b).
- 5 9. A substantially purified or isolated regulatory element from an IRIP nucleic acid from a *Lolium* or *Festuca* species, or a functionally active fragment or variant thereof.
10. A regulatory element according to claim 9 including a nucleotide sequence selected from the group consisting of (a) sequence shown in Figure 34 hereto; (b) complement of the sequence recited in (a) and (c) functionally active fragments and variants of the sequences recited in (a) and (b).
11. A construct including one or more nucleic acids or nucleic acid fragments according to any one of claims 1 to 6.
12. A construct according to claim 11 being a vector and further including one or more promoters and one or more terminators, said nucleic acids or nucleic acid fragments, promoters and terminators being operatively linked.
13. A construct including one or more regulatory elements according to any one of claims 7 to 10.
14. A construct according to claim 13 being a vector and further including one or more further nucleic acid molecules capable of modifying plant response to freezing and/or low temperature stress, and one or more terminators, said regulatory elements, further nucleic acids and terminators being operatively linked.
15. A construct according to claim 14 wherein said further nucleic acid molecule is a nucleic acid or nucleic acid fragment according to any one of claims 1 to 6.
16. A plant cell, plant, plant seed or other plant part, including a construct according to any one of claims 11 to 15.

17. A plant, plant seed or other plant part derived from a plant cell or plant according to claim 16.
18. A method of modifying tolerance of freezing and/or low temperature stress in a plant, said method including introducing into said plant an effective amount of a nucleic acid or nucleic acid fragment according to any one of claims 1 to 6, or a construct according to any one of claims 11 to 15.
19. Use of a nucleic acid or nucleic acid fragment according to any one of claims 1 to 6, and/or nucleotide sequence information thereof, and/or single nucleotide polymorphisms thereof as a molecular genetic marker.
- 10 20. A substantially purified or isolated nucleic acid or nucleic acid fragment including a single nucleotide polymorphism (SNP) from a nucleic acid fragment according to any one of claims 1 to 6.
21. A substantially purified or isolated IRIP or IRIP-like polypeptide from a *Deschampsia* species, or a functionally active fragment or variant thereof.
- 15 22. A polypeptide according to claim 21 wherein said *Deschampsia* species is *Deschampsia antarctica*.
23. A polypeptide according to claim 21 or 22 including an amino acid sequence selected from the group consisting of sequences shown in Figures 10, 13, 16, 19, 22 and 25 hereto; and functionally active fragments and variants thereof.
- 20 24. A substantially purified or isolated IRIP or IRIP-like polypeptide from a *Lolium* or *Festuca* species; or a functionally active fragment or variant thereof.
25. A polypeptide according to claim 24 wherein said *Lolium* or *Festuca* species is perennial ryegrass (*L. perenne*).

26. A polypeptide according to claim 24 or 25 including an amino acid sequence selected from the group consisting of sequences shown in Figures 28 and 31 hereto; and functionally active fragments and variants thereof.

27. A polypeptide encoded by a nucleic acid or nucleic acid fragment according to
5 any one of claims 1 to 6.

28. A preparation for transforming a plant comprising a nucleic acid or nucleic acid fragment according to any one of claims 1 to 6, or a construct according to any one of claims 11 to 15.